The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. LI
No. 1324

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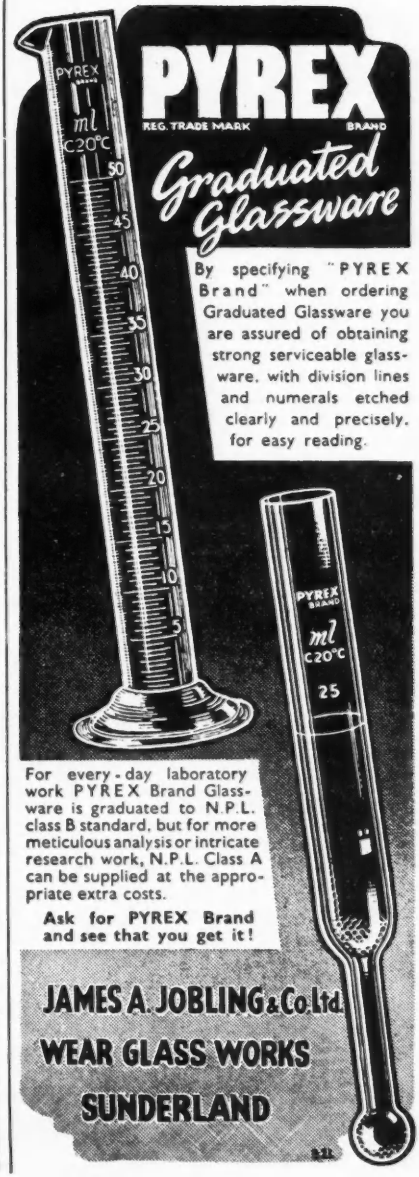

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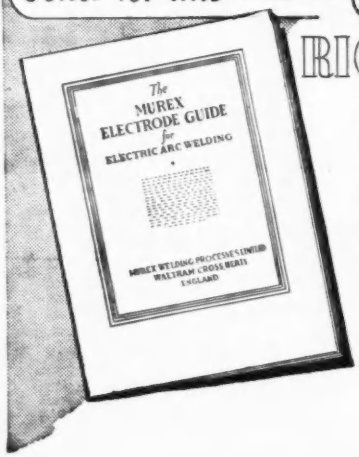

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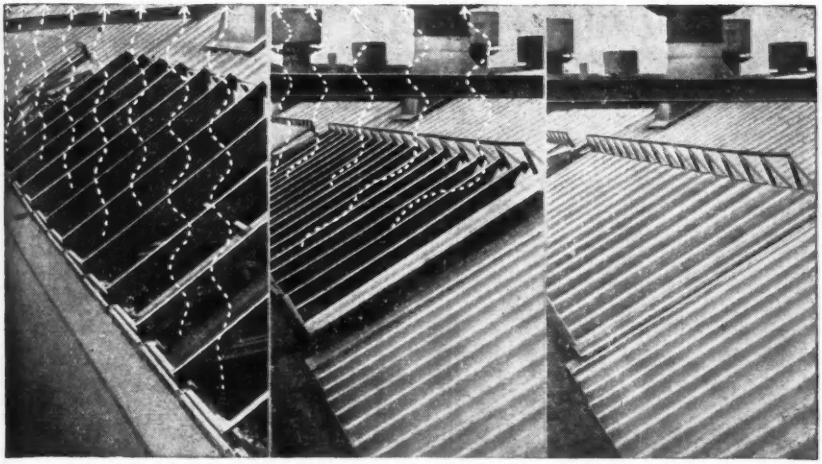

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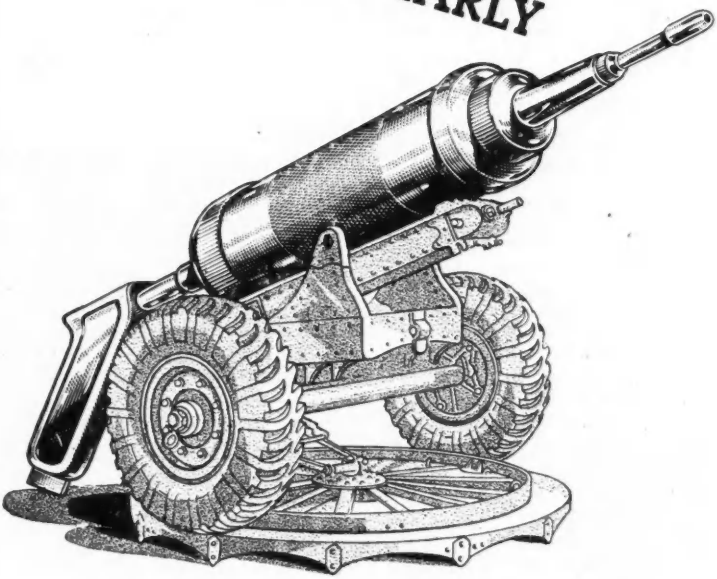

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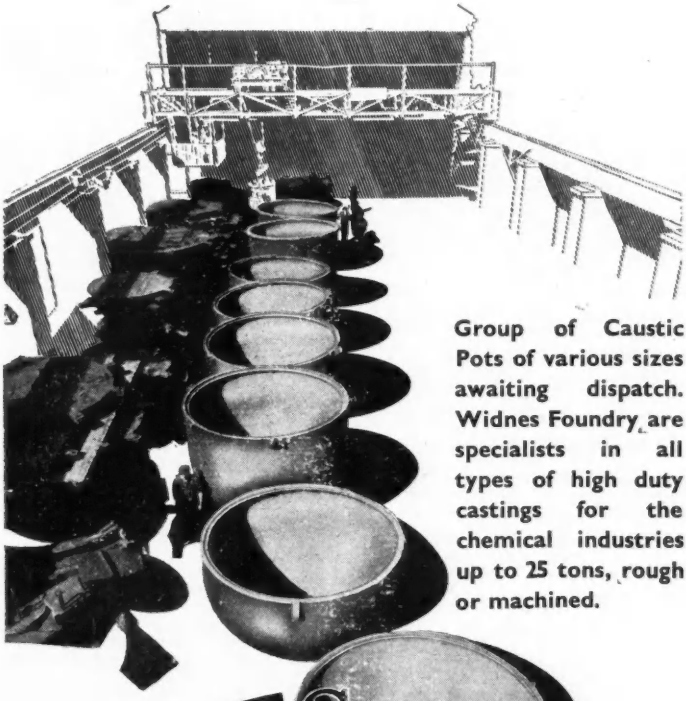

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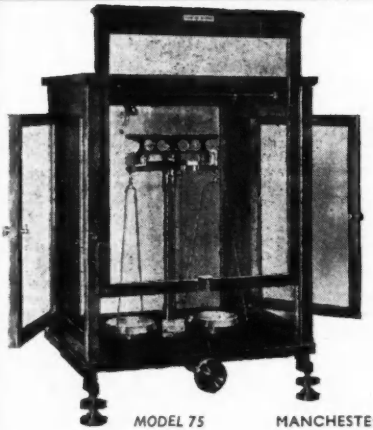

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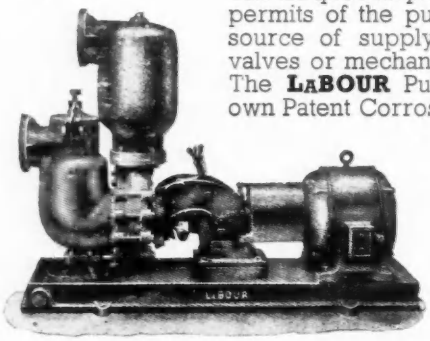

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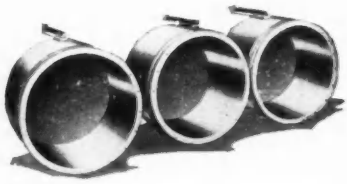

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Water Power in Britain

WHEN delivering the Hinchley Memorial Lecture, on Hydro-Electric Development, Sir Alexander Gibb set himself out, in his own words, to present "a view of the position as I see it to-day, and in doing so to restore a proper balance between the various trends of thought which find expression from time to time in public utterances, in technical papers and in articles to the Press." He stated, moreover, that there appears to exist a certain amount of misconception, and even misrepresentation, as to the part which hydro-electric schemes can play in our national economy.

It cannot be said that Sir Alexander Gibb has painted a rosy picture. He has urged, and quite rightly, that in the interests of coal conservation we should make use of any hydro-electric power that we can make available from natural sources; but he warns us that we cannot from our own resources obtain power as cheaply as it is obtained in Scandinavia and in parts of the American continent. While hydro-electric power has a part to play in this country, this can, by the nature of things, be only a minor part in the fuel economy of the nation, even although it is true that hydro-electric power will be unaffected by wage demands from miners or by absenteeism, and to that extent may be a stabilising factor in the national power costs.

The total amount of power from hydro-electric sources now available in Britain is comparatively small, but the potential power is much greater. Taking all the actual and potential resources into account—including the Severn Barrage—Sir Alexander believes that there is a potential hydro-electric supply in Great Britain of not less than 9541 million units per annum. This represents nearly 40 per cent. of all power generated by authorised undertakers in Great Britain in 1938 and, moreover, represents an annual saving in coal of 6,400,000 tons, based on a pre-war average consumption of coal of 1½ lb./unit. Since, however, in the future this ratio is likely to be nearer 1 lb./unit, the saving in coal will be brought down to something of the order of 4,000,000 tons.

The consumption of electricity in Great Britain during the war has gone up very rapidly indeed and the Central Electricity Board is believed to foresee difficulties in meeting

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the electrical requirements of the country for some years to come. It thus appears that although water power may produce quite a sizeable proportion of our electric power requirements, it will not reduce in any way the present quantity of coal used for this purpose. Our coal position is already giving cause for some anxiety and we should welcome all possible developments of tidal power that will help to conserve our existing coal supplies.

Many of the estimates on which Sir Alexander based his conclusions are not of very recent origin, and it is understood that the Minister of Fuel and Power has this subject under review. We must confess to a feeling of disappointment that the lecturer did not go more deeply into the subject. He told us nothing that is not known to fuel technologists and the particular directons in which a chemical engineer might be expected to direct our policies were omitted from this paper. The price at which the current can be provided is extremely important. As Sir Alexander said, "chemical engineering in certain of its applications depends upon a cheap supply of electrical power."

Cost factors are becoming more favourable to hydro-electric development and a number of these factors, such as the increasing cost of coal and the reduction of the basic rate of interest on borrowed capital, were pointed out in the lecture. But the only positive cost figure given was that it may be possible to produce a tariff in the Highlands which will enable energy to be purchased at a figure round about ¼d./unit, though this would apply only to large blocks of high-load-factor energy. This figure is high compared with many other countries and prevents us from considering the installation of industries which can only flourish where power is really cheap. We have heard of coal-fired stations offering power at as low as 0.4d./unit and for all we know some may have offered to provide power still more cheaply.

We had, frankly, expected to hear what were the prospects of establishing certain chemical industries of importance in this country in view of the availability and price of electric power, but we were disappointed. A good many of the possible industries that might be established in the Highlands were considered by the lecturer, such as the hydrogenation of fish oils, seaweed products, casein, cellulose from wood, and the glass industry. No estimate of the probable power requirements in these industries was made nor was there any assessment as to the extent to which fuel and power governed the cost of production. Indeed, Sir Alexander admitted that the industries he had mentioned "are not, or would not be, large consumers of power in the same sense as electrolytic and electro-thermal industries with which one usually associates the employment of hydro-electric installations."

Everyone will agree that if a hydro-electric installation can be set up to produce current at a cost equal to that of a modern efficient power station worked out on the probable immediate post-war price of coal, or even slightly above this cost, it should be done. The price of coal will tend to rise even though there may be a temporary fall immediately after the war and from the point of view of the economics of coal and power, hydro-electric stations should be encouraged, but many of these stations are situated in inaccessible parts of the country where transport is going to prove more costly than it is in the neighbourhood of the coal fields. Must we generate power in the Highlands and face the cost of transmitting it to centres where there are raw materials, or can we set up new industries based on this power which would not have been possible on power derived from coal-fired stations? A coal-fired station operating on 100 per cent. load factor (*i.e.*, a works operating 24 hours a day on a large scale and generating its own power) can generate power much more cheaply than the modern grid system with its varying load factor. It is time that some authoritative investigation was made into the possibility of introducing here, either through water power or through coal-fired stations, certain industries which demand large amounts of electric power for their operation. Although Britain is already an industrial country its future demands that it shall embark upon new industries: it is of the first importance to plan now what new industries we can expect to develop.

NOTES AND COMMENTS

Fuel Efficiency

CONTINUING its admirable function of directing the attention of industrial chemists to their opportunities of saving fuel by means of the more efficient working of processes, the A.B.C.M. is benefiting both the chemical manufacturers themselves and the nation as a whole; for we presume there is no one to-day who is not prepared to admit the urgent necessity of economising in fuel. For one thing, the war is not yet won; for another, the position of our fuel resources after the war is, to say the least of it, obscure. Chemists, therefore, all over the country should welcome the announcement of another series of discussions sponsored by the Association. Details concerning the first one will be found this week in our "Forthcoming Events" column, and we are glad to see that the double venue—London and Manchester—is maintained; also that non-members of the Association are welcomed. THE CHEMICAL AGE is hoping to be able to play its part in the crusade by reprinting, as before, the introductory lectures and the stimulating discussions which follow them. The wider the audience that can be secured for such an important subject, the less our chemical trade after the war is likely to be hampered by high costs and low supplies of fuel.

Regional Surveys

VOICES crying in the wilderness usually fall upon deaf ears—if our readers will allow us a small Irish bull. Sometimes, however, if they are loud enough, and are supported by a sufficient number of echoes, they may reach the intended goal. The cry for the rational development of our natural resources has been going up for a good while now; one of its most recent manifestations was Mr. Devereux's suggested plan for the West Cumberland region, to which we devoted considerable space in our issue of October 14. It now appears that news of this plan has reached official quarters, and we are told that members of the Government are interested in it. There has been a good deal of loose talk about post-war location of industry, much of it based on very flimsy foundations, but now the idea appears to be on foot that something in the nature of a preliminary survey should be made of the economic resources and possibilities of Britain, based on a regional approach as used in the Devereux plan. This would provide something like a foundation for a national policy to guide industrialists in the location of their factories. Mr. Devereux is to be congratulated if something concrete comes of his efforts.

Chemistry for Mankind

CONSIDERING that Dr. Armstrong's presidential address before the Royal Society of Arts on November 1 combined a remarkably complete review of what chemistry is doing, and is on the point of doing, in the service of mankind, with a stimulating homily on the functions, the duty, and the intellectual standpoint of the chemist himself, we can do it only scant justice in the limited space at our disposal here. Some chemists may say that the president's words were addressed primarily to the layman; and in a sense that is true, for no highly technical material was included in the address. But even if what might be described as the historical part of the speech may be passed over relatively hastily by the trained chemist (we hope to say more about it later), it will do him no harm to study in full Dr. Armstrong's words about chemistry as a career. There are some ideas there—and not merely Dr. Armstrong's own ideas—which may well suggest a few useful trains of thought. We are completely in agreement with Dr. Armstrong in advocating the much more general teaching of science and scientific theory throughout the schools. The deification of the "practical man" is largely bogus; as the president said, if he is really practical, his methods are not far different from those of science. The theory, which he affects to despise, plus a knowledge of scientific method, enables *new* experiments, and *new* techniques to be devised, which have a fair chance of success. There are, alas! many chemists who, like Dr. Armstrong, have witnessed—helplessly—the waste of effort expended in costly experiments

whose failure any trained scientist could have predicted.

Training the Chemist

DR. ARMSTRONG quotes the words of a wise American friend of his to the effect that "every sensible person whose ideas are in advance of his times must have patience and persistence and a sense of humor." Let the exasperated chemist take heart thereby, and let him get on with his slow but sure work of directing training for industrial science into the right course. Little as we may like it, we must admit that Britain, an acknowledged leader in scientific discovery, is reluctant to apply her discoveries until they are ten, twenty, or fifty years old. We are slightly at issue with Dr. Armstrong in his ascription of this attitude to the classical education of our governing classes. A proper classical education develops the spirit of inquiry, we contend; and the trouble, in our view, is that the governing classes, many of them at any rate, are suffering from the effects of a *bad* classical education, just as many of our scientists are labouring under the burden of a bad scientific education. It is merely two aspects of the same problem; the result of "examination-dyspepsia" dulls the wits of classic and scientist alike. If the chemist is to assume, as he should, the Elizabethan spirit of adventurousness, he must be imbued with the confidence that inspired his Tudor forebears. To attain this, art and skill must be demanded from his teachers, and hard work from himself. The call is indeed, as Dr. Armstrong says, for enthusiasts in all ranks of the profession.

Penicillin in the Commons

LIKE innumerable other products of scientific research which are capable of benefiting large numbers of suffering humanity, penicillin has suffered from an overdose of limelight. This fact was brought out in last week's debate in the Commons, although the debate was regrettably not a full-dress affair, but was squeezed into 27 minutes following the Motion for the Adjournment—a beggarly allowance for so vitally important a subject. Credit goes to the Member for Grantham, Mr. Kendall, for raising the subject, especially with regard to the treatment of civilian cases; he has, indeed, shown an unflagging interest in the fortunes of the new drug. He revealed that penicillin production in the United States aggregates now 1200 billion Oxford units and that, so far, about 200 billion units have been sent to this country under Lend-Lease and have helped to save the lives of many wounded service men; and he contended that the fact that Germany has been given all information regarding the production is, if true, not to be regretted, as it enables Allied prisoners of war to be treated.

A Minister's Worries

THE Minister of Health, in his reply, oddly enough made no comment on these facts and figures. He did, however, enlarge on the grave misapprehension—one apparently far too widely held—that penicillin is a sort of panacea for all ailments. Against some diseases it is, in fact, quite ineffective, and he found it worrying to receive applications—even from doctors—for supplies for use in such cases. At present, penicillin is applicable only in hospital conditions of continuous medical supervision. We are glad to hear, however, that the quantity of penicillin allotted to his department has increased, and that by January there will be twice as much available for civilians as there is to-day. In the course of his speech, Mr. Willink quoted from the admirable address on penicillin recently delivered by Professor Henry Cohen, of Liverpool, in which reference was made to the "wide and ignorant demand for its use in conditions in which it has no beneficial action." We fear that this demand is excited by certain sections of the lay Press, which, with the increasing complexity of scientific developments, succeed too easily in presenting a distorted picture. In the circumstances it is perhaps natural that no great attention was paid to the debate by the offending newspapers.

The production of plastics is planned by the North Cork Corporation Creameries, Ltd., Kanturk, Co. Cork, until now a producer of casein. The necessary formaldehyde is produced in large quantities by the Irish Alcohol Factory, Ltd., Dundalk, Co. Louth.

Recent Developments in Analytical Chemistry—XIII

(From Our Analytical Correspondent)

SINCE the appearance of the last article in this series, the *Annual Reports on the Progress of Chemistry* for 1943 have been published. It will be remembered that owing to the shortage of paper a report on Analytical Chemistry was held over from last year. It is therefore rather disappointing to find that the report this year consists of only two sections, dealing with the analysis of steels and with fractional distillation. While these subjects are of considerable importance, and the articles dealing with them therefore valuable, it will undoubtedly be widely felt that the Reports are not giving to analytical methods the place that is their due.

Accuracy of Methods

There has been a recent review[1] dealing with the precise measurement of volume in titration analysis. The review includes a description of the apparatus and the special technique for precision work. It is shown that results obtained by these methods can give an accuracy of the same order as that which is obtained by employing weighed portions of standard solutions. It is obvious that to obtain the best results on the production side, not only must analytical control be carried out on a considerable scale, but in addition the accuracy of these controlled methods must be precisely known. The method of investigating precision has been described.[2] In the first place, the analytical method is investigated, not as a routine method, but ideally, in order to determine the highest precision which the method is capable of attaining. If this is satisfactory the method is then tested over a long period of time (*e.g.*, a year) as a routine analysis. From the results obtained over this period statistical methods enable one to calculate a "limit of uncertainty." Routine analyses can then be guaranteed within this limit. It is found that, as a rule, normal control methods, applied as routine analyses, show a variation which is approximately 1½ to 2½ times as great as that when the method is applied as a precision analysis.

The Committee on Microchemical Balances of the American Chemical Society has been investigating the possibility of applying a specification for the reproducibility of weighings made on microchemical balances. Although so far no specification has been laid down, the investigation has shown[3] that balances at present on the market show a very wide variation in this respect. The test carried out consisted of a series of ten weighings of two 1 g. weights against each other, and a series of ten weighings replacing the 1 g. weights by 10 g. weights. Variations as great as 22 μg. have been found to occur, while over a large number of balances the average probable error was found to be as high as ± 7 μg. It is, therefore, obvious that users of microchemical balances should keep a close check on the reproducibility of their instruments.

An intensive investigation into the errors which may affect balances of the Kuhlmann type has been published recently.[4] Errors to be anticipated can be classified roughly into two types. Those of the first type depend primarily on the balance case and balance room, and include such factors as temperature and humidity. The other type is concerned with defects in the balance itself. Among such may be faulty construction of the rider beam or of the knife edges. A number of recommendations are made which, if carried out, will avoid many of the undesirable effects. It is interesting to note that some factors arising from the sitting of the balance may be largely counteracted by the manufacturer. Thus, for example, humidity effects are largely centred around the knife edges and their supports. Experiments showed that the variation from this source could be cut down very considerably either by impregnating the pores of agate bearings with a wax or plastic, or by using a material, such as boron carbide, a good deal less hygroscopic than agate.

Molecular Distillation

The subject of high-vacuum stills was last dealt with in this series[5] in 1942. Apart from a section dealing with the same subject in the report already mentioned,[6] a number of designs for apparatus have been described. Matchett and Levine[7] describe an apparatus which is capable of handling anything from 0.25 to 5 g. of material. This apparatus is shown in Fig. 1. The material

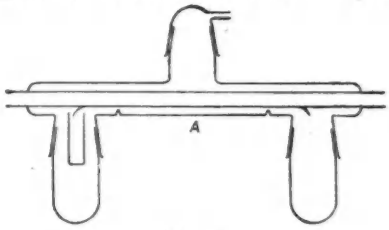

Fig. 1.

to be distilled is placed in the centre of the receptacle at A. After evacuation, the apparatus is tilted slightly. The condensate runs along the condenser until it reaches the small glass rod, down which it runs into the receiver. As designed, the apparatus will take off two successive fractions by tilting first to one side, then to the other. Another apparatus[8] has been devised with a number of points in view, the most important of which being that it could be used by a number of operators, either for molecular distillation or for vacuum sublimation at one and the same time, and that it should be capable of handling quantities of material over a considerable range. The principle is that a vessel with twelve ground-glass openings is attached to a vacuum line which gives 10^{-5} mm. and has an auxiliary degassing line. Vessels of various natures can then be joined through the ground-glass points to the source of vacuum. A number of these are shown in Fig. 2. The vessel

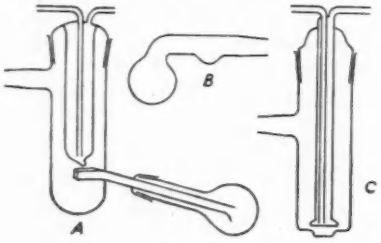

Fig. 2.

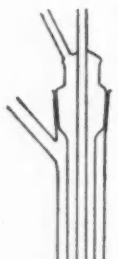

Fig. 3.

at A is a molecular still with a capacity of 1-15 ml. That at B is a modified retort which permits one to deal with small quantities of viscous materials A sublimation apparatus to treat small quantities of substances is shown at C. The functioning of these will be obvious from the diagrams.

The last apparatus is very similar to the sublimation tubes described by Hubacher,[9] designed to deal with quantities varying from 2 g. down to 0.001 g. of material. One of these is shown in Fig. 3.

A molecular still of novel design[10] has been applied to separations involving vitamins, sterols, higher fatty acids and natural fats and oils, both from the preparative and the analytical aspects. The evaporator is placed around the condenser in such a way as to provide a large area of evaporation-surface, and a relatively small drainage area. Incoming distillate is spread in a thin film over the glass of the evaporator surface by a rotor which is magnetically driven. The condenser is attached through a ground glass joint so that it is easily removed, along with the fractions, as desired. Rapid and quantitative collection of either liquid or solid distillates is thus possible.

Estimation of Aluminium

Two gravimetric procedures have been worked out for the estimation of aluminium. the first of these[11] employs ammonium nitrosophenylhydroxylamine—better known as cupferron—as precipitant. Cupferron has already been applied to the estimation of iron, titanium, and zirconium, but these metals are precipitated in strongly acid solution, whereas aluminium is not. A separation is therefore achieved by a preliminary precipitation in strongly acid solution. After filtration the solution is buffered with acetate to *p*H 4.8, at which point the aluminium complex is completely precipitated. The second gravimetric method for aluminium is applied[12] to the determination of the metal in magnesium alloys. The precipitating solution contains 10 g. of urea, 5 g. of ammonium chloride, and 5 g. of succinic acid in 300 ml. of water. Iron is prevented from interfering by the addition of ammonium bisulphite solution and phenylhydrazine, and the precipitation is carried out in a hot solution which is just alkaline to methyl orange. The basic succinate is precipitated as a dense, easily filterable, compound which is simple to wash, 1 per cent. ammonium chloride being used for this purpose. The other bivalent metals occurring in magnesium alloys are not precipitated under these conditions. The precipitate is ignited at 1300°C. for one hour in order to convert it to non-hygroscopic oxide.

Several colorimetric procedures for determining aluminium have also been described. The use of hæmatoxylin has been proposed by Tartakovski,[13] Houghton,[14] and Stafford and Wyatt.[15] Tartakovski utilises in his method the fact that the stable colour formed by aluminium with the reagent in dilute acetic acid solution is intensified in the presence of sodium acetate, adding a fixed amount of sodium hydroxide to the solution in order to obtain this effect. The method of Houghton is applied to the determination of aluminium in water, and is capable of determining as little as 0.02 parts per million in 25 ml. of water. The third method is also applied to water analysis, and is intended for the estimation of both iron and aluminium. The iron is first extracted as the thiocyanate, using an amyl alcohol/ether mixture. The aluminium is determined in the extracted solution. Down to 0.01 parts per million of aluminium may

be determined with an accuracy of at least ±0.01 parts per million as long as the iron content is not more than ten times that of the aluminium. While hæmatoxylin is the most satisfactory reagent, it is also possible to employ aurin-tricarboxylic acid to produce the colour. This reagent has also been employed by other authors[16] for the photometric determination of aluminium as an analytical control method. The strength of colour transmitted at 5000 Å. is measured, and read off against a calibration curve. The precision, as a works control method, was found to be of the order of 1 per cent.

Alizarin-S has been applied as a reagent by Haywood, Harrison and Wood,[17] and by Cholak, Hubbard and Story.[18] The former workers apply the method to the coloured solution which results from adding the reagent to a solution of the aluminium acetate in acetic acid (*p*H 4.0), and have been able to determine from 0 to 12 per cent. of the metal in magnesium alloys. The reaction is stated to be specific for aluminium. The latter workers first precipitate the aluminium together with iron as phosphate, from a solution obtained from biological materials. This precipitate is redissolved in dilute HCl and silica is removed. This is followed by the addition of cupferron, and the iron complex which forms is extracted with an ether/benzene mixture. The aluminium colour is then developed in alkaline solution and is measured at 5800 Å. An alternative spectrographic method, using bismuth as internal standard, and modified from an earlier described method[19] to give increased accuracy, is also detailed by these workers.

Fluorine

Because there are now limits for the fluorine content of foods, a sub-committee was set up by the Society of Public Analysts to investigate methods of determining small amounts of fluorine in foods. The sub-committee has now reported,[20] and has recommended a suitable method. After ashing, the material is steam-distilled as hydrofluosilicic acid from the solution containing an excess of perchloric acid. The acidity of the distillate is adjusted, and standard quantities of 0.01 per cent. alizarin-S and of thorium nitrate solutions are added in a Nessler glass. Similar amounts of the reagents are added to a control glass, and the colour of this is then adjusted to match the unknown by the addition of standard sodium fluoride solution. The amount of fluorine in the unknown is, of course, equivalent to the amount added in the standard solution.

The estimation of fluorine by means of the decolorisation and colorimetric measurement of a zirconium-alizarin lake has been critically investigated[21] in order to determine the effect of a variety of factors on the results obtained. Methods have been devised which take the findings into consideration both for insoluble and soluble fluorides. The fact that fluorine will also decolorise thorium-alizarin lake has been utilised for the estimation of this element,[22] the general procedure being similar to that for the zirconium method. With thorium, however, the reaction is more rapid, and there is the added advantage that there is less tendency for the reagents to precipitate. When the estimation is applied to fluorine in natural waters it is often possible to carry it out without prior distillation of the element unless when aluminium and phosphate may interfere.

It is possible to obtain moderately accurate results in a gravimetric estimation of fluoride by precipitation as calcium fluoride.[23] This is precipitated from boiling solution by the addition of calcium hydroxyide. Excess calcium hydroxide and other hydroxides are taken into solution by formic or acetic acid, and the precipitate is then filtered off. After weighing, the precipitate is titrated against standard acid to determine residual calcium hydroxide, a correction derived from this titration being applied to the weight of the precipitate.

Chlorine

The estimation of chloride gravimetrically in the presence of hydrosulphide or of sulphide is achieved[24] by a prior precipitation with copper nitrate solution. The precipitate of copper hydrosulphide or sulphide is filtered off, and the chloride is then precipitated as silver chloride, which is weighed. Small amounts of chloride may be determined colorimetrically[25] by an indirect method. Ferric alum solution is added, and the cloride is then precipitated with an excess of standard silver nitrate solution. The precipitate is filtered off, and the silver in its turn precipitated with an excess of standard ammonium thiocyanate solution. The colour of the ferric thiocyanate solution remaining is then measured in a colorimeter, after a second filtration has removed the silver thiocyanate. From this, the original concentration of chloride can be determined. The nephelometric method for the estimation of chloride has been modified so that it can be used in the Hellige turbidimeter.[26] By this modification the results are as accurate, and instead of having to prepare reference standards it is now possible to read off the turbidity of the solution directly on the scale of the instrument, and convert this figure into chloride content by use of a calibration curve.

Iodine

A turbidimetric method for iodine, which depends, not on the amount of turbidity but on the time required for its formation,[27] makes use of the formation of methyl

iodide. To the solution containing iodine and potassium iodide are added standard amounts of acetone and caustic potash solution. If the conditions are rigidly controlled, there is a direct relation between the iodine content and the time required for the turbidity to form. A representative figure is 34 mins. for an iodine concentration of 0.3 per cent.

An indirect volumetric estimation of iodide which is applicable in the presence of 10 to 100 times the amount of chloride or bromide has been reported.[28] To the iodide solution, acetic acid and sodium acetate are added, followed by bromine water in excess until the strong colour of free iodine is bleached, indicating that the iodine has been transformed to iodate. Excess of bromine is destroyed by formic acid. Potassium iodide solution is added, and the whole is acidified with dilute sulphuric acid, and titrated against sodium thiosulphate solution. By this method of estimation a multiplication factor of 6 is applied. The procedure is particularly useful for determining silver iodide in photographic emulsions, which present difficulties in the normal methods of estimation because of the insolubility of silver iodide, and the problem presented by the elimination of the gelatin. A similar procedure has been adopted[29] for the determination of iodine in iodised salt, the main difference being that the excess bromine is removed with sulphite and phenol.

Separation of Iodate

It is possible[30] to determine iodate in the presence of four times the amount of bromate or chlorate by using phthalic acid to buffer the solution to *p*H 4.0. This is due to the fact that when iodate and iodide react, the *p*H increases sufficiently to prevent the interfering ions from reacting appreciably. Iodometric determinations of iodate, in the presence of copper, or conversely of copper in the presence of iodate, have been investigated by the same authors.[31] The iodate and copper salt are treated with excess iodide and acid until reaction is complete. Sodium citrate, which forms a stable complex with copper ions, is then added. As a consequence, the copper-iodide reaction reverses quantitatively, releasing iodine equivalent to the iodate. This is then titrated with sodium thiosulphate solution. A conductimetric estimation of iodate[32] is based on the reaction of $IO_3' + 6H^+ + 6S_2O_3'' \rightleftharpoons I' + 3S_4O_6'' + 3H_2O$. A slight excess of sodium thiosulphate and a little potassium iodide are added, and the whole is titrated conductimetrically with standard hydrochloric acid solution. Too great excess of sodium thiosulphate or of potassium iodide should be avoided, as otherwise the initial conductivity of the solution will be too high and the end point will be less precise.

Clark and Jones employ, for determining halogens in organic compounds,[33] oxidation by permanganate in acid solution. After the wet oxidation, the liberated halogen is trapped in 1 per cent. hydrazine sulphate solution, being subsequently estimated as halide. In another method[34] the halogen is displaced quantitatively by catalytically activated hydrogen obtained by the action of alkali on nickel-aluminium alloy. The halide is obtained in the form of the corresponding alkali salt, which may then be determined by any of the normal procedures. The method, which requires no special apparatus or reagents, has been applied successfully to a wide range of aliphatic, aromatic, alicyclic, and heterocyclic compounds, showing an accuracy of ±0.3 per cent. of the total amount of halogen present.

Halogen Determination

Variations of the Stepanow method have been published by several authors. In one method[35] 3 to 10 mg. are weighed and placed in a reaction vessel, followed by 1 ml. of absolute ethanol. A condenser is attached and 0.2 g. of metallic sodium is added through the condenser. After about 3 mins., when the ethanol has been transformed to sodium ethylate, the excess sodium is destroyed by another ml. of ethanol, added through the condenser. Two ml. of halogen-free water are now added and the whole is warmed for 2 to 3 mins. with a microburner, placed 5 cm. below the reaction vessel. The sodium halide is then determined either gravimetrically or by a Volhard titration. It is recommended that a centrifuge tube should be used as reaction vessel, so as to save time in separating the silver halide at the end of the estimation. Umhoeffer,[36] instead of using ethanol, recommends *iso*-propyl or *sec*-butyl alcohol, which gives a slower rate of reaction with sodium and, while being better solvents for chlorinated hydrocarbons than is ethanol, are yet sufficiently miscible with water to need no separate extraction before estimation of the halide. Halogen in aliphatic compounds may be determined[37] by heating with pyridine in a sealed tube. The resulting pyridinium salt has an ionisable halogen which may be determined by normal methods.

Combustion methods have also been described by a number of authors. In a method devised for the micro-determination of halogen and hydrogen simultaneously,[38] the substance is burnt in the ordinary Pregl fashion in a current of oxygen with platinum contacts. Moisture is absorbed in calcium chloride, and the halogen in alkali/hydrogen peroxide, in which it is determined by a Volhard titration. In the rapid method[39] by which the substance is burnt

in a fast stream of oxygen in an unpacked tube, chlorine is once more absorbed in alkali/hydrogen peroxide, and determined by titration. In a variation proposed by Winter[40] the sample containing halogen is decomposed by burning it in a stream of combustible gas. The products of combustion are collected in a sodium-carbonate/sodium-arsenite solution. The silver halide thus formed is determined by a modified Volhard titration. The method has been applied to a wide range of compounds, from gases to high-melting solids, some of these containing more than one halogen. The method showed an accuracy of ± 0.1 per cent.

Ionic halogens in organic compounds[41] have been analysed by dissolving in a suitable solvent, adding mercuric oxycyanide, and titrating the liberated hydroxy ions with standard sulphuric acid. If necessary, the substance may be taken up in caustic soda solution, which is then neutralised before addition of the reagent.

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Terpene Derivatives

Chemical Developments in the U.S.A.

"RECENT Chemical Developments in Wood Rosin and Terpene Derivatives" was the title of a paper by Mr. W. L. Cahall, presented to the London Section of the Oil and Colour Chemists' Association on October 20. In it were reviewed some of the products developed recently in the Hercules Naval Stores Research Laboratories in the U.S.A.

Properties and uses of "Staybelite," the well-known Hercules hydrogenated wood rosin, were detailed, while the future possibilities of dehydrogenated rosin and hydroabietyl alcohol were also discussed. Another familiar Hercules product, the "Poly-pale" polymerised rosin, was described and its manifold uses outlined. "Stabinol," used as a soil stabilising product, is a combination of a specially treated rosin with other chemicals, and is now in commercial production. New derivatives of terpene hydrocarbons also in the commercial production stage are: the terpene ethers, formed by the α- and β-pinenes reacting with monohydric or polyhydric alcohols; paracymene, produced by catalytic dehydrogenation of monocyclic terpenes; "Thanite," a mixture of terpene thiocyanoacetates used in the preparation of insect sprays; terpin hydrate, an intermediate in the manufacture of terpineol and terpinyl esters; and finally dipentene, an acyclic terpene which is being converted into isoprene for synthetic rubber, though, in the author's view, the process would probably not be economic in peace time.

In the discussion which followed, Mr. W. Garvie expressed the opinion that rosin and turpentine would within 50 years occupy as important a place in the chemical industry as the coal-tar and petroleum oils have to-day. Chemists, particularly in the synthetic resin industry, should concentrate far more on these products, as the quantities available would be unlimited.

The Nobel Prize for physiology and medicine for 1943—the first to be awarded since 1939—is shared by PROFESSOR HENRIK DAM, of Copenhagen, who reached the United States in 1940, and PROFESSOR EDWARD A. DOISY, professor of biochemistry at St. Louis University, for the discovery of and research into vitamin K. The absence of vitamin K is characterised by hæmorrhages due to a failure of the blood to clot properly. It is fat-soluble, and found in liver fats, green vegetables, and to a lesser extent in cereals. It is stable to heat and light and is destroyed by alkalis. Two crystalline substances have been obtained from natural sources, *viz*: K_1 from alfalfa oil and K_2 from putrefied sardine meal.

Parliamentary Topics

Survey of Fuel Resources

IN the House of Commons last week, Mr. Salt asked what progress was being made with the national coal survey; and to what extent it had been extended to include all sources of energy, such as petroleum, lignite, peat, wood and charcoal.

Major Lloyd George: Over a number of years the D.S.I.R., together with other organisations, has obtained data on the quality of the coal of the majority of the seams and on their extent. Recently, in association with the Coal Commission and the Ministry of Fuel and Power, considerable progress has been made with a survey to determine the amounts and qualities of our workable reserves of coal. It is intended to undertake more detailed surveys.

The exploration of the petroleum resources of this country is being carried out by various oil companies under licences from the Ministry of Fuel and Power. Only approximate data are available about the resources of lignite, peat, wood and charcoal, but these materials are economically of very much less importance than coal in this country. Special attention has been paid during the war to these materials as sources of carbon compounds.

Motor Fuel Research

Sir G. Schuster asked the Minister of Fuel and Power whether sufficient progress had yet been made with steam wagons, producer-gas lorries or coal-gas cars, to justify any hope that post-war motor transport in Great Britain could make substantial use of home-produced coal; and if not, what steps were being taken to expedite large-scale research and development.

Major Lloyd George: As a result of the work of the D.S.I.R. and the Mines Department and of the scheme operated in the last two years by the Ministry of War Transport, considerable experience has now been obtained of the use in this country of producer gas for road transport, which suggests that it is not likely that home-produced solid fuel would be made substantial use of after the war, so long as liquid fuel is available at a reasonable price.

Coal as Raw Material

Mr. Salt asked for full particulars regarding research and development work on foot, and the approximate expenditure devoted to, the more efficient utilisation of coal, both as a source of fuel and as a raw material for the chemical industry.

Major Lloyd George: Research and development work into the more efficient utilisation of coal both as a source of power and as a raw material for the chemical industry is being conducted by the D.S.I.R., by industrial research associations and by the research departments of many individual firms, all of which are planning to expand this work after the war. The work of the Government and the research associations is being co ordinated by the Standing Consultative Conference on Fuel Research.

The estimated gross expenditure of the Fuel Research Organisation of my Department for the current year amounts to £145,000. In addition, the total approximate annual expenditure by the three research associations most concerned (British Coal Utilisation Research Association, Gas Research Board, Coke Research Association) totals at present about £300,000, of which about £63,000 is provided by the Government. Other bodies, such as the Electrical and Allied Industries Research Association and the Iron and Steel Research Council devote part of their efforts to work in this field. I have no estimate of the expenditure on this work incurred by individual firms.

New Aviation Fuel

Mr. J. J. Lawson asked a question about the new aviation fuel which had been discovered in the U.S.A.; and how this discovery affected the future of fuel in this country.

Mr. Lennox-Boyd: I am aware of developments in the U.S.A. in the production of a new aviation fuel. It is, however, too early to state what effect these developments will have on the future of fuel in this country, but production could be undertaken here if necessary.

Release of Chemists

Mr. Harvey, who asked the Minister of Labour how many chemists, physicists and engineers had been released from war service during the past two years and guided into coal research, was told by Mr. Bevin that no releases for this purpose had taken place.

German Industrial Equipment

Sir L. Lyle, who asked whether the Allies would consider requisitioning all modern equipment of German factories, was told by Mr. George Hall that, while a decision could only be taken by agreement of all the Allies he expected the confiscation of such equipment as might seem expedient on security grounds.

Sodium Chlorate

Major Mills asked the Minister of Agriculture whether he would arrange for adequate supplies of sodium chlorate to be available next spring for the destruction of nettles in permanent pastures. Mr. Hudson: I am informed by the Minister of Supply that the supply position does not permit of this at present, but the matter will be reconsidered as soon as increased supplies become available.

Corrosion Inhibitors

More Papers from the A.C.S. New York Meeting

THE opening paper of the second session, dealing with the principles governing the use of soluble inhibitors, was presented by U. R. Evans, of Cambridge University (England). In it, factors deciding between corrosion and inhibition were discussed. It is pointed out that, when the immediate corrosion product is sparingly soluble, attack is likely to be stifled. However, when the immediate product is soluble but a secondary product is only sparingly soluble, attack will usually continue. Anodic inhibitors function by forming a sparingly soluble anodic product. When the corrosion reaction is under cathodic control, anodic inhibitors are likely to be "dangerous," since when added in insufficient concentrations they tend to localise attack but may result in intensified attack at those areas which continue to corrode. Cathodic inhibitors form sparingly soluble products on the cathode areas. Such inhibitors are likely to be "safe," since they do not cause intensification of attack but are generally less effective in reducing the total corrosion reaction than are anodic inhibitors.

Metallic Salts

Zinc, manganese, and chromium salts as corrosion inhibitors were discussed by R. S. Thornhill, also of Cambridge University. The "dangerous" behaviour of anodic inhibitors, such as chromates, is pointed out. Several cathodic inhibitors were examined in considerable detail, since such inhibitors are usually considered to be "safe." Preliminary tests with the following cations—Fe^{++}, Mg^{++}, Cu^{++}, Co^{++}, Sn^{++}, Ba^{++}, Zn^{++}, Mn^{++}, and Cr^{++}—showed that only the last three merited further study. It was found that the rate of corrosion of steel by tap water was greatly reduced by adding small quantities of zinc and manganese salts. Chromium salts brought about some inhibition at low but not at high concentrations. At relatively high concentrations of zinc and chromium salts, marked intensification of attack occurred at the water-line zone of partially immersed steel specimens. However, manganese salts appeared to be free from this defect. Because of this intensification of water-line attack, zinc and chromium salts must be considered as dangerous inhibitors.

N. A. Bailey and C. E. Erb, of D. W. Haering & Co., Inc., speaking on the many inorganic and organic chemicals that have been used to reduce the corrosion rate of metals and alloys in water, brine, acids, and other aqueous media, noted that the effects of such chemicals are, according to present-day theories, due to oxide or other protective films, formed *in situ* as the result of chemical reaction, as well as to films formed physically by adsorption on the metal surface. Other inhibitors, rather loosely classed as organo-metallics, have come into fairly general use within the past decade. In these compounds organic and inorganic radicals, each having definite inhibitory properties in themselves, are in chemical combination; the inhibiting properties are generally much greater than those of either the organic or inorganic materials from which they are derived. More complete protection is obtained usually with a much lower concentration. The use of inhibitors is discussed in connection with cooling systems, boilers, brine, acid solutions, steam, etc., as well as concentrations necessary for control of corrosion under different operating conditions and in various media.

Threshold Treatment

The three main uses of threshold treatment—the addition of very low concentrations of the molecularly dehydrated phosphate to water—formed the subject of a paper by G. B. Hatch and O. Rice (Hall Laboratories, Inc., Pittsburgh). This treatment is effective in the elimination of calcium carbonate scale, iron oxide deposition and corrosion control. The massive calcium carbonate layer traditionally relied upon for the alleviation of excessive corrosion is eliminated by the treatment; it is replaced by a thin adsorbed film of the phosphate which exerts a marked inhibitive action upon the corrosion of the metal surface without interference with the flow characteristics of heat transfer. The use of the glassy phosphates for the elimination of calcium carbonate scale and iron deposition is reviewed in the paper, from both the theoretical and practical aspects, and factors which govern the prevention of scale by this treatment are discussed. Several typical plant applications which illustrate the important features of these uses of a phosphate glass, Calgon, are described. Corrosion control with Calgon and the factors which affect the formation of protective films upon the metal surfaces—particularly ferrous metals—by this glassy phosphate are discussed.

Chromate corrosion inhibitors in bimetallic systems were reviewed by Mare Darrin (Mutual Chemical Co., of America, Baltimore). His report shows how it is practical to use chromate for combating, under conditions encountered in practice, the accelerated corrosion of one of two dissimilar metals placed in contact in an aqueous medium. The effect, on various bimetallic

systems, of time of exposure, temperature, aeration, submergence of panels, initial *p*H and chromate concentration, etc., is shown. Data include corrosion scores, weight loss, depth of pits, types of pits, changes in *p*H, and chromate consumption. Practical applications are described for air-conditioning systems, refrigeration brines, automobile systems, diesel engines, power rectifiers, and other recirculating and quiescent systems. Chromate inhibits chiefly by anodic polarisation, and its protection is not affected by aeration. Under some conditions a visible protective film is formed which is self-healing. The consumption of chromate in the chemical protection of a ferrous surface decreases as the concentration of the chromate is increased. Where there is an exposed cathodic metal such as brass, a fairly high concentration of chromate is required to protect ferrous parts, especially if there are stagnant regions or old rust accumulations. If calcium chloride is added to prevent freezing, a higher concentration of chromate is required, up to about 5000 p.p.m.; but, in general, a moderate concentration (500 p.p.m) is sufficient for the protection of ferrous parts of most equipment. In a rapidly moving stream, not subject to local depletion of chromate, very much lower concentrations may be employed.

Industrial Water Corrosion

Galvanic corrosion tests were made by H. R. Copson (Research Laboratory, The International Nickel Co., Inc.), on steel coupled to nickel in tap water. With a 3 to 1 area ratio of nickel to steel, galvanic corrosion of the steel was appreciable but not excessive. Treating the water with 300 parts per million of sodium chromate practically inhibited all corrosion, provided the steel was rubbed occasionally. Undisturbed steel was liable to pit. Treating the water with lime to *p*H 11 cut down the total corrosion but localised it, with the result that the maximum rate of penetration was increased.

A comprehensive survey of corrosion rate in industrial recirculating water systems was made by G. F. Lebrecht, of Anheuser-Busch, Inc., covering a period of over three years. Tests were conducted on different types of equipment, such as ammonia condensers using recirculating water passing through forced-draught cooling towers, air coolers, single-pass water heater, four-pass hot water heater, and pasteurisers of total submersion and water fall types. Different methods of determining corrosion rate were developed. Various arrangements of specimens on Chapman testers and their apparent results are described. Systems of control included carbonate-balance, silicates, lime, nitrates, phosphates, combinations of these treatments, electrolytic, galvanic, and paints. In the ammonia condensers, tests were conducted with tubes of various materials in actual use. Tests were made to determine to some degree which metal characteristics affect corrosion in present operating conditions. In some equipment, the amount of treatment of chemicals should apparently be based upon the area of surface to be protected. In other instances, the amount of treatment of chemicals should be based on the volume of water and concentration of chemicals used.

In a paper by G. G. Eldredge and R. B. Mears (Research Laboratories, Aluminum Co., of America), the use of inhibitors of the corrosion of aluminium is reviewed and some new data are presented. Inhibitors for aluminium behave differently in various acids. Chromates are effective in phosphoric acid but not in hydrochloric. Nitrogen compounds and pickling inhibitors that are effective for steel are usually more effective for aluminium in hydrochloric acid than in phosphoric acid. No very effective inhibitors for aluminium in sulphuric acid are known. In water, chromates, silicates, and soluble oils were most effective. Against galvanic corrosion by contact with copper, the same materials functioned to some extent, especially when the sodium chloride content was as low as 10 p.p.m. In neutral salt solutions, chromates function by increasing the anodic polarisation. In sodium carbonate solutions, silicates and fluosilicates are very effective; in sodium hydroxide, colloids such as glues are stated to be satisfactory. In solutions of sodium hypochlorite, sodium disilicate is effective as it is also reported to be in chlorine water.

Water may be an inhibitor of attack of aluminium in some nearly anhydrous organic chemicals, such as organic acids, phenols, and alcohols. Borates and phosphates are used as inhibitors in ethylene glycol solutions. Chromates have been successfully used in alcohol solutions. For some cases, especially in insulation materials, slowly soluble chromates have an advantage.

The difficulty of evaluating long-term corrosion of light alloys has been successfully overcome by the U.S. Navy and Aeronautics research departments. Light metal alloys are subject, unless properly processed, to slow and insidious corrosion whereby the metal becomes brittle without any marked change in surface appearance. Long-term tests for this defect must be carried out in environments simulating service conditions, and absence of disturbance is essential. A seaside site at Hampton Roads Naval Air Station has been selected, where facilities for conducting prolonged and uninterrupted weathering tests are available. Two types of exposure are arranged for: one in a marine atmosphere, but with protection from spray; the other in conditions of repeated tidal immersion in sea water.

Hydro-Electric Development—II*

Its Influence on the Chemical and Allied Industries

by SIR ALEXANDER GIBB, G.B.E., C.B., LL.D., F.R.S.

(*Continued from* THE CHEMICAL AGE, *November* 4, 1944, *p.* 440)

AT the last census about 11 per cent. of the population of Great Britain were domiciled in Scotland. Taking the Highlands as being that area covered by the Hydro Electric Development Act, its population represented only 2 per cent. of the same total. Unless industrial demands in Scotland are to be considerably higher *per capita* than in England and Wales, it would appear that 11 per cent. of the total power generated in Great Britain would fulfil its needs. But, by the time that full development of hydro-electric power in Scotland, as at present envisaged, has been achieved, we may anticipate that its output will represent 15 per cent., and not 11 per cent., of the total amount generated in the country as a whole. In other words, assuming an even distribution of diversified industry, Scotland should be in a position to export bulk supplies of power across the Boarder of the order of 2000 million units per annum. Long-distance transmission is, however, expensive and we cannot afford to transmit power over great distances without seriously considering whether it cannot be equally well utilised at or near the place of generation.

Highland Industries

How, then, is the supply of power to be utilised which will eventually become available in the Highlands? By nature, the Highlander is primarily a farmer and a fisherman, but if at first prejudices exist against mechanisation in house and farm, it is unlikely that they will persist indefinitely, and, although mineral resources are lacking, there seems at first sight no reason why both land and sea should not be made to yield other valuable raw materials for processing in a series of small factories appropriately sited. With its extensive seaboard, Northern Scotland is richly endowed with facilities for landing the harvests of its fishing fleets, and here one might expect to have a raw material ready to hand for use in canneries and for processing to obtain such derivatives as fish-liver oils and the vital products obtained from them. Other marine oils of an inferior character find applications in industry and are frequently hydrogenated and used for edible purposes. Unfortunately, industrial developments of such a nature are handicapped by the intermittent nature of the fishing season and the absence from the catch of adequate supplies of fish yielding the higher-grade products. Nevertheless, I do not feel that this possibility should be ruled out entirely.

Considerable interest has been shown in recent years in seaweed products and a Scottish Seaweed Research Association has been formed, one of the primary objects of which is to ascertain whether sufficient seaweed of a suitable kind is available to support a chemical industry based on the use of this raw material. Factories are already in being in Scotland which are operating on an increasing scale.

Casein for Plastics

Cattle rearing is already one of the principal occupations of the Highlanders and this might well be developed with a view to increased supplies of milk to provide the raw material for yet further process industries. Such, for instance, is the production of casein. Until recently no casein suitable for plastics was produced in this country.

Parts of the Highlands are very suitable for afforestation, and although home-grown timber could not be expected to replace to any appreciable extent imported supplies for the paper industry, the possibility should not be overlooked of utilising this indigenous raw material in the production of cellulose and its derivatives for other purposes.

In spite of the dearth of inorganic raw materials, there is one, namely, sand of very high quality, in the neighbourhood of Lochaline on the Sound of Mull, which might form the basis for a glass industry, including optical glass.

Admittedly, the industries I have mentioned would not be large consumers of power in the same sense as electrolytic and electro-thermal industries with which one usually associates the employment of hydro-electric installations. Nevertheless, I feel that the possibilities to the small user should not be overlooked, particularly where these might bring prosperity and new interests to the local inhabitants. Taking Scotland as a whole, there is no doubt that it offers conditions which should attract electro-chemical and electro-metallurgical industries, and from these major consumers of power there will follow the many chemical industries which are associated with such products as calcium carbide, and which are perhaps more appropriately conducted in existing industrial areas.

It is hardly necessary for me to remind

* The Fifth Hinchley Memorial Lecture, delivered before the Institution of Chemical Engineers on October 27 (*Abridged*).

those who embark upon industrial schemes in the more recondite parts of Scotland of the need for considering very carefully beforehand the question of the social amenities which will be required by the staff and operatives who will make up the new works communities. Nowadays, and very properly so, this is an important factor no matter from what source this personnel is derived, but it is of vital consequence in cases where transfers from existing industrial areas, either in Scotland or elsewhere, are involved.

With the exception of the Severn Estuary, England and Wales as a whole are comparatively ill-provided with sites capable of hydro-electric development, many catchment areas having been earmarked for the storage of water for use in our big cities. There can be no direct influence, therefore, by hydro-electric development as at present envisaged on industry in England and Wales with the exception of some small contribution from North Wales and a much larger contribution from the Severn Estuary. For the present, then, England and Wales will have to rely almost entirely on steam power and there is little or no scope for the development of industry in which power represents a large proportion of production cost.

The important heavy chemical industry of this country has established itself principally in such areas as Cheshire, South Lancashire, Tees-side, and the Midlands, for reasons which are quite apart from proximity to the source of power. Whether this will always be so, I cannot say. It may be decided to harness other tidal estuaries such as those of the Dee, Mersey, and Humber in order to add to our power resources, but at the moment it is doubtful whether any of these schemes can be justified on economic grounds. Again, further investigation of Central and South Wales and of the West Country rivers may reveal valuable inland sources not yet tapped.

The Severn Estuary

I approach the area around the Severn Estuary with the knowledge that this is a veritable battleground of contending interests. This is an area where chemical and allied industries should find the advantages they are seeking—cheap power, raw materials, good ports, and a pool of labour not too far removed from the industrial area of the Midlands and the markets of the Home Counties. Those champions of the utilisation of coal, the Welsh Reconstruction Advisory Council, have made the following statement, with which I heartily agree. "Wales may eventually need an integrated coal-oil-power and chemical industry, developed as a whole." That is the very essence of the South Wales problem, and both coal and tidal power have their contributions to make. Here alone south of the Border do we find an area where water power can really assist in releasing coal, and in so doing offer prospects of the establishment on sound economic lines of diverse industries utilising our indigenous raw materials. That the Welsh miner will suffer is disproved by the fact that we shall be obliged to increase our coal production in spite of hydro-electric development, in order to keep pace with increased power consumption alone, without even considering the many other uses of coal. It is sad to reflect that, had the Brabazon Report in 1933 been acted upon promptly, and detailed plans put in hand right away, we should have been much nearer the day when chemical industry in its varied branches might find in South Wales one of its most favourable locations.

"Cheap Power" Industries

I have so far deliberately omitted other than a passing reference to the "cheap power" industries which I think should be encouraged in this country, but have merely indicated their likely location. Before coming to the close of my address, however, I would like to touch upon this point very briefly, and to examine one or two examples. Firstly, we have to remember that, speaking generally, hydro-electric power cannot be produced in this country at a figure which compares favourably with that in Canada, U.S.A., or Norway, for example. Industries in which cost of power represents a high proportion of production costs must, therefore, be ruled out, except on grounds of national security. The manufacture of silicon carbide comes in this category, for, with electrical energy at a farthing a unit, the cost of power represents about 60 per cent. of the prewar selling price of the American product.

Then there are industries in which the cost of power would be such that, although higher in this country than abroad, the effect on the selling price of products would not be so great as to preclude their competing successfully in the home market, and possibly even in the world market as well, if economies were effected by higher technical efficiency. Within this group we may include as typical examples the production of aluminium and fused alumina, magnesium, ferro-alloys, and calcium carbide. On a similar basis to that taken for silicon carbide, it is of interest to note that the cost of power represents some 28 per cent. of the selling price in the case of aluminium, 26 per cent. in the case of fused alumina, 2 per cent. in the electrolytic reduction of magnesium, 30-40 per cent. for the various ferro-alloys, and 15 per cent. for calcium carbide. Where electro-thermal

methods are employed in the production of magnesium the percentage is, of course, higher. If, for similar purposes, power from the general grid supply is going to cost ½d. a unit, as may well be the case, you will see at once that these percentages are increased threefold, and production at competitive prices of the raw materials I have just quoted, with the exception of electrolytic magnesium, becomes impossible.

Calcium carbide has become a raw material of fundamental importance to industry, and more especially to chemical industry. Our present output is likely to be required for acetylene for welding purposes alone. Acetylene, however, is a starting point in the synthesis of a large number of highly important organic chemicals, including substances not only vital to the chemical industry itself, but to allied industries dependent upon it such as the plastic industry. I have been told that one-fifteenth part of the entire German chemical industry was devoted to the manufacture of carbide. We in this country cannot afford to neglect such a valuable asset. The necessary raw materials, coke and lime, are available in abundance in Great Britain, and I feel that the development of this industry in Scotland and South Wales would appear to be not only desirable, but inevitable.

I have endeavoured to present to you a view of the position as I see it to-day, and in so doing to restore a proper balance between the various trends of thought which find expressions from time to time in public utterances, in technical papers, and in articles to the press. In doing this I have deliberately avoided making detailed recommendations as to specific industries which might be established and suggesting suitable locations for these.

Economics and national security are closely interwoven in these matters, and it may be deemed advisable to introduce uneconomic types of manufacture in order to prevent this country from again finding itself in the critical position which arose both during the last and present wars. These matters of national policy could not be covered in a brief review of this kind, and decisions as to which industries are to be encouraged and where these are to be sited, are matters for those controlling the country's destiny to decide.

Personal Notes

MR. W. E. AYLWIN, M.C., M.A., F.Inst.P., has been appointed a director of The Midland Tar Distillers, Ltd. Formerly with the Anglo-Iranian Oil Company, Mr. Aylwin joined his present firm as assistant general works manager in 1932. In 1938 he was appointed general works manager, which post he continues to hold.

MR. ARTHUR S. WEYGANDT, formerly director of the experimental laboratory of Du Pont's Grasselli Chemicals department, Cleveland (Ohio), has arrived in Buenos Aires to take over the post of technical director of Duperial Argentina, the Argentine concern in which interests of Du Pont and I.C.I. are combined.

The Victoria Cross has been awarded, posthumously, to CAPTAIN MICHAEL ALLMAND, Indian Armoured Corps (attd. 6th Gurkha Rifles) for superb gallantry, outstanding leadership, and protracted heroism in the Burma campaign. Captain Allmand was a son of Professor A. J. Allmand, M.C., D.Sc., F.R.S., F.R.I.C., Assistant Principal of King's College and Daniell Professor of Chemistry in the University of London.

The American Section of the Society of Chemical Industry announces the election of NORMAN A. SHEPARD, chemical director of the American Cyanamid Co., as its chairman and FRANK J. CURTIS, vice-president of Monsanto Chemical Co., as vice-chairman, until July, 1945. CYRIL S. KIMBALL and J. W. H. RANDALL were re-elected honorary secretary and honorary treasurer, respectively.

The need to develop new methods of treating coal to meet war-time requirements led some time ago to a joint research project undertaken by Powell Duffryn, Ltd., and De La Rue (Plastics), Ltd. The progress of this work has now reached a stage at which it has been decided to form a joint company for research into coal-treatment. The technical director of the research company is to be MR. J. G. BENNETT, who resigned his directorship of the B.C.U.R.A. for this purpose. It is intended to establish research laboratories in London and to start operations early in the new year.

Obituary

MR. R. A. BELLWOOD, who died on October 27, aged 77, after a short illness, had been a director since 1918 of Rose, Downs and Thompson, Ltd., chemical plant manufacturers, Hull. He had been connected with that company for upwards of 60 years.

PROFESSOR JOSEPH C. W. FRAZER, of Johns Hopkins University, died on July 28, aged 68. Dr. Frazer became B. N. Baker Professor of Chemistry at Johns Hopkins in 1906, and head of the department from 1914 to 1935. He headed the research laboratory of the U.S. Bureau of Mines in Pittsburgh from 1905 to 1911, and was, during the first World War, in charge of the Baltimore branch of the Chemical Warfare Service laboratory.

General News

The address of the *Pharmaceutical Journal* is now 33 Bedford Place, London, W.C.1, and the telephone number CHAncery 6387.

Powell Duffryn, the big colliery group, and De La Rue Plastics are to form a research company to develop new products for home and export markets (*see* also p. 469).

The Institute of Physics announced on November 2 the election of nine new Fellows and 32 new Associates. Nine Subscribers and 26 Students were also admitted.

Jicwood, Ltd., a subsidiary of Airscrew Co., is extending the application of synthetic-resin bonded plywood to the production of "prefabricated" houses.

Wage increases for drug and fine chemical workers were announced on November 3. Men will receive 4s. a week more, women 2s. 6d., juniors 3s. and 4s. according to age, and girls 1s. 6d. and 2s. 6d. according to age.

A summary of current literature on Water Pollution Research (Vol. XVI, No. 10), containing abstracts up to October 1943, has been published by H.M.S.O. (2s.)

Superseding DTD 133B, Specification DTD 133C has been issued by the Ministry of Aircraft Production, dealing with aluminium alloy sand or die castings (heat-treated), price 1s. The Ministry of Supply has published a pamphlet on the Turning of Aluminium Pistons with Diamond Tools (No. 70-450; price 6d.).

About 200 names of persons in neutral countries, with whom dealings of any kind are unlawful, are added to the schedule in the Trading with the Enemy (Specified Persons) (Amendment) (No. 13) Order, 1944 (S.R. & O. 1944, No. 1193). These include Industria Metalúrgica y Plástica Argentina S.A. (I.M.P.A.), Buenos Aires; Société des Schistes Bitumineux de Tanger, Tangier; and Nitratos de Castilla S.A. (Nicas), Bilbao, **Spain.** A large number of deletions is also included.

The huge increase in the demand from the Services for smoke-generating chemicals has led to an interesting advance in the method of handling the materials during processing. Freedom from damp in the course of manufacture or transit is essential, so that speed in handling becomes a matter of prime importance. To meet the speed-up in production, a factory turning out smoke materials has decided to replace the hand sack barrows formerly used by "Electricar" battery-driven power trucks. Reports show that the unloading and packing of the chemicals has been much simplified thereby; economy is also served, as the trucks, fully loaded, can be operated at as little as 1d. per mile.

From Week to Week

Foreign News

The Belgian Congo supplied the United Nations with 144,000 tons of copper last year, as compared with 124,000 in 1942.

A cellulose plant at Foggia is among the chemical factories in liberated Italy which are on the point of resuming production, states the report of the Allied Commission's sub-commission for industry.

The Trinidad Petroleum Development Co., produced, during the 5 years to July 31, over 16,000,000 barrels of oil, an annual average of 3,200,000 barrels. Reserves proved to be substantially greater than pre-war estimates indicated.

The largest factory for the manufacture of tannin in South America was recently put into operation at Porto Murtinho, on the upper reaches of the Paraguay river in south-western Brazil. The new factory will use quebracho as raw material.

The Oxychloride Cement Association, 1010 Vermont Avenue, N.W., Washington 5, D.C., has recently been formed. Its members are: The Dow Chemical Co.; F. E. Schundler and Co.; and Westvaco Chlorine Products Corp.

In the Soviet Union, the operation of the second series of electrolytic baths at the Stalinsk Aluminium Plant in Kemerovo Oblast was made possible by the completion of the Stalinsk Heat and Power Plant. The aluminium produced in the new tanks is reported to be of the highest quality.

Exploitation of a magnesite deposit occurring on Margarita Island, off the coast of Venezuela, about 150 miles west of Trinidad, is reported to be increasing as a result of export demand. Fifty metric tons of magnesite were recently exported to the Antilles and arrangements are being made for the export of up to 1000 tons to South American countries.

In connection with a note giving details of the extensive tests which are being applied to DDT by the U.S. Department of Agriculture, notably in the fruit-growing districts of the Pacific Coast of America, *J. Chem. Educ.* (1944, *21*, 9, p. 418) records that the compound was actually synthesised in 1874 by a student of Strasbourg, Othmar Zeidler, in the course of routine work for a thesis he was preparing. He regarded it as merely a casual piece of test-tube evolution, and had no idea of the insecticidal value of the formula, which he recorded in a brief note of six lines to the Proceedings of the German Chemical Society.

The new bauxite plant at Takoradi, Gold Coast, part of a £2,000,000 scheme, is now working; capacity of the ropeway and loader is 300 tons per hour.

A lignite research prize has been instituted in Germany by the Braunkohle Industrie-Verein, Halle/Saale, where technical and scientific lignite research is concentrated.

Output of the chemical industry in the Protectorate of Bohemia and Moravia has increased by 41 per cent. in the period 1940-1943.

In Switzerland, the production of synthetic rubber is to start in two factories, one in Buehler, Appenzell, the other in Altstetten, near Zürich.

Mica, quartz and graphite are still available to Germany from territory under her control, according to a claim made by Professor Dr. Cissarz, head of the Reich Institute for Soil Exploration.

Wire made of nickel-chromium, duralumin, and other alloys, will be produced by works at Bilbao, Spain, the establishment of which by the Sociedad Industrias Termoeléctricas has been authorised. Weldless steel tubes up to a diameter of 273 mm. will be produced at works erected in Bilbao by the Sociedad Española de Construcciones Babcock & Wilcox, the Spanish subsidiary of the well-known British concern.

In Cuba, interest in oil-well drilling in the Jarahueca field in Las Villas Province has been stimulated by the success of one of the operating companies which drilled three producing wells in succession. Oil brought in is of low specific gravity, similar to gas oil, and can be used as a motor fuel in its natural state. Production of natural gasoline in the Motembo field, on the other hand, is declining steadily, and there is little drilling activity.

Forthcoming Events

The South Wales section of the **Institute of Fuel** meets at the Royal Institution, Swansea, on **November 14,** at 6.30 p.m., to hear Dr. Davies read a paper on "The Underground Gasification of Coal."

A joint conference of the **Chemical Engineering Group,** the **Agriculture Group** (Society of Chemical Industry), and the **Institution of Chemical Engineers** on Grass Drying will be held at the Institution of Mechanical Engineers, Storey's Gate, S.W.1, on **November 14,** at 2 p.m. The following papers will be delivered: "Grass Drying—Chemical Aspects," by Dr. S. J. Watson; "Grass Drying—Engineering Aspects," by Mr. A. Goldberg and Mr. A. C. Bartelli; "Grass Drying—The Farmer's Viewpoint," by Mr. D. Fairclough.

The **Institute of Fuel** meets on **November 15,** at 2.30 p.m., at the Institution of Mechanical Engineers, Storey's Gate, S.W.1. Mr. B. F. Carthauser will deliver a paper on "The Development and Design of Shell Type Boilers."

A joint meeting of the **Society of Chemical Industry,** with the **Royal Institute of Chemistry** will take place on **November 15,** at 6.30 p.m., in the Chamber of Commerce, Birmingham, when Mr. C. W. Bonniksen will present a paper on "Some Properties and Applications of Alginic Acids and Alginates."

A joint meeting of the Food Group and the S. Wales Section of the **Society of Chemical Industry** and the Cardiff Section of the **Royal Institute of Chemistry,** will be held on **November 15,** at 6.30 p.m., at the Technical College, Newport, Mon., when Dr. E. B. Hughes will present a paper—with lantern slides—entitled: "Chemistry in the Kitchen."

The first subject in the second series of technical discussions on Fuel Economy in the Chemical Industry, arranged by the **A.B.C.M.,** will be "The Future of Lime/Soda Softening," by Mr. W. F. Gerrard (Feedwater Specialists Co.). It will take place in the Reynolds Hall, College of Technology, Manchester, at 3 p.m., on **November 15,** and again in the rooms of the Geological Society, Burlington House, London, W.1, at 2.30 p.m., on **November 29.** As previously, non-members of the Association are invited to the meetings and should notify (for the London meeting) Mr. A. J. Holden, Association of British Chemical Manufacturers, 166 Piccadilly, W.1; (for the Manchester meeting) Mr. W. Murray, The Liverpool Borax Co., Ltd., Maxwell House, 6 St. Paul's Square, Liverpool, 3, not later than the day before the meeting.

"Oxidation of Phenol," is the title of a lecture to be given on **November 16,** at 5.30 p.m., by Prof. R. D. Haworth, F.R.S., to the **Chemical Society,** in the University College of N. Wales, Bangor.

The Manchester section of the **Oil and Colour Chemists' Association** meets on **November 16,** at 2 p.m., at the Engineers' Club, Albert Square, Manchester, when a talk on "Paint—Past, Present and Future," will be given by Mr. E. W. Webster.

The **Chemical Society** meets at Burlington House on **November 16,** at 2.30 p.m., to hear the following papers: "Investigation of the Occurrence of the Co-ordinate of Dative Link by Electric Dipole Moment Measurement," by G. M. Phillips, J. S. Hunter and L. E. Sutton. "A Constitutional Synthesis of Cellobiose and Gentiobiose," by Mrs. G. A. Gilbert, F. Smith and M. Stacey.

Professor E. K. Rideal will deliver three lectures on Colloid Science to the London section of the **Oil and Colour Chemists' Association** on **November 16, 23 and 30,** at 6.30 p.m., in the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1. The general heading of the lectures is "Surface

Action;" that of the first lecture is "Heterogeneous Catalysis," while Lectures 2 and 3 bear the title "Monolayers and Monolayer Reactions." An inclusive charge of 10s. for the three lectures will be made to members and their friends and applications, together with remittances, should be forwarded in advance to David E. Roe, Esq., hon. secretary, c/o Atlas Preservative Co., Ltd., Fraser Road, Erith, Kent.

A lecture on "The Value of the Resonance Concept in Chemistry" will be given to the **Chemical Society** by Mr. R. P. Bell, F.R.S., on **November 17**, at 7.15 p.m., in the Royal Technical College, Glasgow.

The Plastics Group of the **Society of Chemical Industry** meets on **November 17**, at 2.30 p.m., at Burlington House, when Dr. K. F. Tuckett and Miss E. M. Frith will read a paper on "Polymer Plasticiser Interaction."

At a meeting of the **Institution of Chemical Engineers**, North-Western branch, on **November 18**, at 3 p.m., in the Reynolds Hall, College of Technology, Manchester, a paper, "Calder-Fox Scrubbers and the Factors Influencing their Performance," will be presented by Mr. G. Lowrie Fairs.

The next meeting of the Manchester Group, **International Society of Leather Trades Chemists** will be held at the Engineers' Club, 17a Albert Square, Manchester, on **November 18**. Papers will be read on "Engineering Developments and their Application to the Tanning Industry," by Mr. Ralph Jebb, and on "The Factors Governing the Fixation of Tannin in Leather as Determined by Continuous Washing with Water," by Mr. C. Gordon Turner.

Professor I. M. Heilbron will deliver the Aldred Lecture on "The New Insecticidal Material DDT," at the **Royal Society of Arts**, on **November 22**, at 1.45 p.m.

The inauguration of a Liverpool centre for the North-Western Section of the **Institute of Fuel** will take place on **November 22** at the Municipal Annexe, Dale Street, Liverpool, at 2.30 p.m., when the President and Dr. Grumell will deliver addresses.

The third paper in the series on thermal insulation, entitled "The Practical Aspect of Reheating and Heat-Treatment Furnace Insulation" will be read by Mr. A. Stirling, before the Midland Section of the **Institute of Fuel**, at the James Watt Memorial Institute, Birmingham, on **November 22**, at 2.30 p.m.

Company News

Metal Industries, Ltd., report an interim dividend of 3 per cent. (2½ per cent.) on both the "A" and "B" ordinary shares.

The Trinidad Petroleum Development Co., Ltd., announce a net profit, for the year to July 31, of £182,340 (£183,974), gross profit stands at £232,340 (£303,974); tax absorbs £50,000 (£120,000), and £114,244 (£93,904) is being carried forward. The ordinary dividend remains unchanged at 15 per cent.

Chemical and Allied Stocks and Shares

REFLECTING the further upward movement in gilt-edged stocks stimulated by the terms of the new 1¾ per cent. Exchequer Bond issue, industrial shares have also shown a rising trend, and in sympathy with the lower yields on gilt-edged, prices in most other sections of markets have been inclined to improve.

Turner & Newall were again favoured and strengthened further to 84s. Imperial Chemical moved up to 40s. 3d. at one time, but later reacted to 39s. 6d. Lever & Unilever were relatively steady at 46s., with Lever N.V. 45s. 9d., Dunlop Rubber 49s., and Borax Consolidated 35s. 9d. Metal Box moved up to 92s. 6d., and Murex to 101s. 3d. De La Rue strengthened to 195s., and Powell Duffryn were 9d. higher at 24s. 3d., following news of the research developments between the last-named company and De La Rue Plastics. Imperial Smelting improved to 14s. 6d. awaiting the forthcoming dividend decision, and elsewhere International Paint moved up to 115s. Other paint shares were higher, including Goodlass Wall 10s. ordinary at 19s., and Pinchin Johnson 10s. shares at 40s. British Plaster Board continued to attract attention, advancing to 41s. 3d. Associated Cement were steady at 63s. 6d. awaiting the interim dividend announcement.

Iron and steel shares were favoured on yield considerations, with Tube Investments firm at 97s. prior to the dividend statement, Stewarts & Lloyds 55s. 6d., and Babcock & Wilcox 52s. 9d., while Clarke Chapman strengthened to 45s. 3d. Richard Thomas were 13s. 3d., and Ruston & Hornsby advanced to 48s. 6d. Allied Ironfounders were better at 52s. 9d., awaiting declaration of the interim dividend. Textile machinery manufacturing issues attracted more attention, Howard & Bullough further improving to 25s., Platt Bros. to 18s. 1½d., and Fairbairn Lawson to 8s. 3d. Triplex Glass rallied 2s. at 44s., reflecting recognition of the strong balance-sheet and the fact that the higher 15 per cent. dividend is well below actual earnings on the shares. A small feature was a rise to 6s. 7½d. in Timber Fireproofing 2s. shares on the higher dividend of 17½ per cent. and the decision to issue one new share at 4s. in the proportion of one for every four shares at present held.

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Erinoid 5s. shares changed hands around 11s. 6d., and British Industrial Plastics 2s. ordinary around 7s., while among other shares of companies interested in plastics, Lacrinoid Products were more active around 5s. 6d. Lewis Berger rallied strongly to 106s., market expectations being that the forthcoming results are again likely to create a good impression. National Gas Engine shares were 18s. 3d., Gas Light & Coke ordinary 22s. 10½d., and Low Temperature Carbonisation 2s. shares transferred up to 2s. 7½d. Wall Paper Manufacturers deferred moved up further with other leading industrials, and were 46s. 3d. Nairn & Greenwich were 76s. 3d., and Barry & Staines 53s. Elsewhere, British Match rose further to 41s. 6d., Ransome & Marles to 87s., and British Oxygen to 90s., while British Aluminium were steady at 47s. 3d.

W. J. Bush held their rise to 70s. B. Laporte were 82s. 6d., and Greeff-Chemicals 5s. ordinary 8s., with Monsanto Chemicals 5½ per cent. preference 23s. 6d. United Molasses at 38s. 1½d. lost part of an earlier rise. Amalgamated Metal were 18s. 9d., and J. Brockhouse strengthened to 78s. 6d., awaiting the financial results. Boots Drug were higher at 57s. 3d., Timothy Whites 41s., and Sangers 29s., but Beechams deferred eased slightly to 19s. 6d. Textile shares were inclined to improve, and there were a number of good features, including British Celanese which rallied to 30s. Oil shares were generally well maintained, although Anglo-Iranian moved back to 116s. 10½d. Trinidad Petroleum Development strengthened to 81s. 3d. on the big increase in production figures shown by the report.

British Chemical Prices

Market Reports

CONDITIONS in most sections of the London general chemicals market remain steady, with the movement of supplies against contracts continuing satisfactorily. Fresh bookings have been on a moderate scale and the undertone throughout the market is firm. In the soda products section a fair amount of inquiry is in evidence for bichromate of soda and caustic soda, while bicarbonate of soda, Glauber salt and salt cake are in good call. Nitrate and hyposulphite of soda are firm. In the potash section acid phosphate remains steady; British makers of permanganate are well booked and a fair volume of fresh inquiry is circulating. A tight supply position continues to be reported for yellow prussiate of potash. In other directions the lead oxides are receiving a steady inquiry and zinc oxide is a good market. No change is reported from the acid section; oxalic acid continues in short supply. Formaldehyde enjoys a steady inquiry. Activity in the coal-tar products market has been fairly well spread over most sections, with cresylic acid and carbolic acid crystals in steady demand. Pyridine remains quiet and a fair trade is passing in pitch.

MANCHESTER.—Prices have been steady to firm in all sections of the Manchester chemical market during the past week, and little in the way of actual movement falls to be reported. Both new inquiry and actual additional business have been on no more than a moderate scale, but, on the whole, sellers have had little of which to complain regarding the rate at which supplies have been called for against the orders already placed, fair deliveries having been made of the general run of soda products, alum, carbonate and oxide of magnesia, the ammonia products, and both the light and heavy acids. Most descriptions of tar products, including creosote oil, carbolic acid, and benzol, are in steady request against contracts, though not a great deal in the way of new business has been transacted during the week.

GLASGOW.—In the Scottish heavy chemical trade during the past week, business in the home trade has been moderate. Export inquiries remain rather restricted. Prices keep very firm with no actual changes to report.

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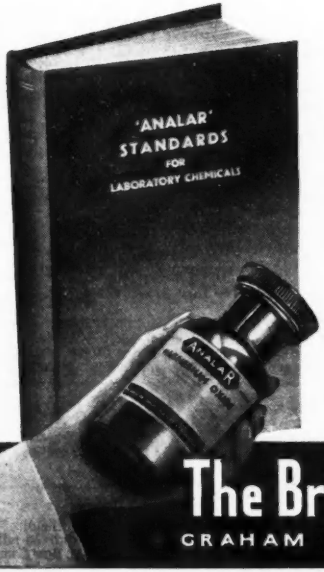

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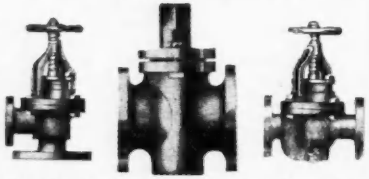

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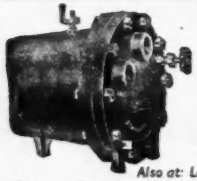

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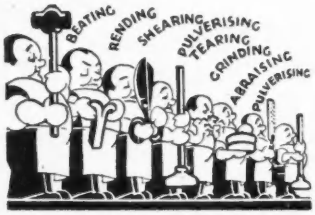

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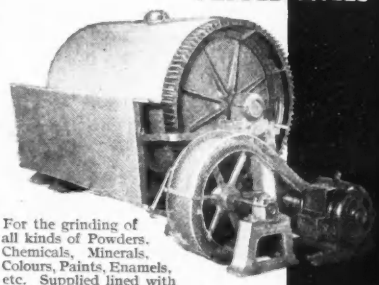

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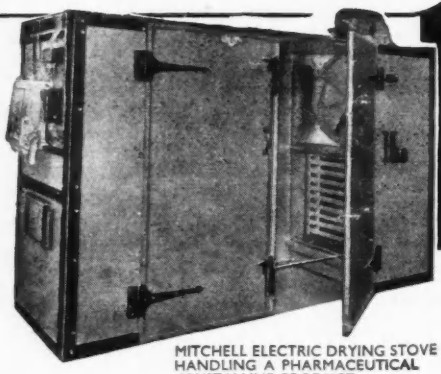

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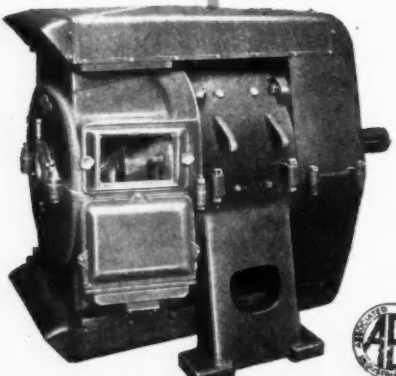

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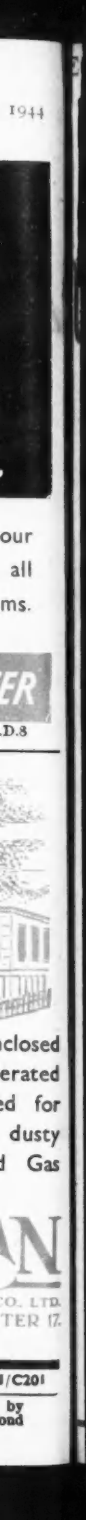
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